THE NAVIGATOR

AFRP 50-3 Volume XXI, Number 3 Fall 1974

NAV OF NOTE

Major General Howard M. Fish is the Director of Budget, Office of the Comptroller, Headquarters, US Air Force, Washington, DC.

A native of Minnesota, General Fish entered the Army Air Forces in 1942 and served as an aerial gunner at Tyndall Field, FL. He entered advanced navigator training at Monroe, LA, in November 1943, and received his navigator rating and commission as a second lieutenant in the Army Air Corps in July 1944.

From October 1944, he served as a navigator in the European Theater on a B-17 aircraft crew with the 419th Bombardment Squadron, 301st Bombardment Group in Italy. He was shot down over Vienna, Austria, in February 1945, and spent the remainder of the war as a prisoner of war in Germany.

In November 1945, he attended a student navigator refresher course at Ellington Field, TX, and at Fairfield-Suisun Air Base, CA. In February 1946, he was assigned as assistant statistical control officer, Chanute Field, IL, and in April 1946, he was transferred to Orlando, FL, for statistical control indoctrination training.

General Fish returned to Germany in July 1946, serving first in Berlin, then at Tempelhof AB, and later in Wiesbaden as a statistical control officer. He also flew in the Berlin Airlift.

He returned to the United States in July 1949, and trained as a navigator- bombardier at Mather AFB, CA. In April 1950, he was assigned to the 84th Bombardment Squadron at Langley AFB, VA.

In July 1950, he was transferred to the 162nd Tactical Reconnaissance Squadron, which was immediately sent to Korea where he flew 63 combat missions. General Fish later served as a navigator on the crew of the commanding general, Eighth Army, in Korea. In March 1951, he was assigned as Chief, Program Analysis Section, 374th Troop Carrier Wing, Far Eastern Air Forces.

He returned to Langley AFB in June 1951 to train replacement combat crews for B-26 aircraft units in Korea. Initially, he served as a squadron navigator in the 4400th Combat Crew Training Group and later as a squadron executive officer and group director of operations and training. In January 1954, General Fish attended the Air Command and Staff College, Maxwell AFB, AL. He returned to Langley AFB as executive officer for the 405th Fighter Bomber Wing, but in June 1956, he entered the University of Chicago and was graduated in August 1957 with an MBA.

He was transferred to Europe in October 1957, serving first as Wing Comptroller for the 60th Troop Carrier Wing at Druex AB, France, and then as Comptroller, 7310th Air Base Wing, Rhein-Main AB, Germany.

In July 1960, he entered the Armed Forces Staff College at Norfolk, VA, and in January 1961 he was assigned as Director of Data Automation, and later as Assistant Deputy Chief of Staff, Comptroller, Headquarters Eastern Transport Air Force, McGuire AFB, NJ.

In August 1963, he entered the Air War College, Maxwell AFB, AL, and, while there, received a master's degree in international affairs from George Washington University. In July 1964, he was assigned as plans and programs officer in the Directorate of Plans, HQ USAF, Washington, DC. He was named Assistant for Analysis to the Deputy Director of Plans for Force Development in December 1967.

In March 1969, he was named Director of Tactical Analysis, Seventh Air Force, Tan Son Nhut Airfield, Republic of Vietnam.

General Fish returned to HQ USAF in July 1970 as the Deputy Director of Doctrine, Concepts and Objectives, Deputy Chief of Staff, Plans and Operations. He was appointed Deputy Director of the Budget, Office of the Comptroller, in February 1971 and became Director of the Budget in October 1973.

A master navigator, General Fish was promoted to the grade of major general effective 1 June 1973, with date of rank 1 July 1970.

FROM THE EDITOR

MEET YOUR NEW EDITOR: Major Louis A. Kun is a 1961 graduate of the University of Pittsburgh where he majored in English and Journalism. He was commissioned in February 1962 from Officer Training School and received his navigator wings in December 1962 at James Connolly AFB, Texas. Major Kun was assigned to Charleston AFB, South Carolina, with the Military Airlift Command, and spent eight years flying MAC C-130Es and C-141s. After a tour in AC-130 gunships at Ubon, Thailand, he came to Mather AFB, California, and has been at Mather since June of 1972. As well as being an academic instructor with thousands of platform hours, Major Kun has amassed over 6500 flying hours.

As the new editor of THE NAVIGATOR magazine, I wholeheartedly solicit your support in making this the best recurring periodical in the Air Force. THE NAVIGATOR has always had an excellent reputation as a semi-technical, professional interest publication and I intend to do my very best to uphold that reputation. But there is no way that this magazine can maintain its status without assistance from you people out in the field. With a total staff of three people, it is impossible to internally create a readable, accurate and interesting issue, nor are we expected to do so.

THE NAVIGATOR is the only publication in the Air Force that is for navigators, about navigators, by navigators. All of the Major Commands have been contributors in the past and almost every weapons system, antiquated and sophisticated, has been discussed in THE NAVIGATOR. Dozens and dozens of navigation techniques, numerous unique jobs, and scores of human interest stories have graced the pages of your magazine. I say *your* magazine because it is just that. Without these excellent contributions from you, the navigator reader, THE NAVIGATOR magazine would cease to exist.

So I appeal to you to keep those contributions coming as you have in the past. It would be a very rare person who does not have something of interest to say to other navigators. All it requires is your sitting down, putting it on paper and sending it to us. You don't have to be an accomplished writer to be published in the magazine. Provide us with a skeleton and we'll carry the ball from there. So dip into your memory banks and let us know about those things you want to share with your fellow navigators. With your help, we will make THE NAVIGATOR the best recurring publication in the Air Force.

Editor, THE NAVIGATOR

TO THE EDITOR

Dear Editor:

I am not a navigator, but an avionics officer who is currently in charge of all USAF navigation systems repairmen training on a resident basis. The magazine applies to the 328X1 enlisted career personnel in that they work on navigation systems exclusively. An occasional article pointed in their direction and some distribution aimed at this service component will definitely enhance the science of navigation as well as build more enthusiasm. Of course, the technical aspects of equipment would be most applicable. I would be happy to furnish more details if needed.

Thomas C. Hruskocy, Capt, USAF
Chief, Navigation Systems Branch
School of Applied Aerosp. Sci.
Keesler AFB, Mississippi

We'd be glad to receive and possibly publish such articles, especially if they stressed closer operations-maintenance relationships, more effective operations, or quality control of navigation equipment maintenance. How do you navs feel?

Ed.

Dear Editor:

Attached are copies of our Flight Test Engineer course curriculum. It is under revision at this time, but I will send you copies of the new one as soon as it is published. In addition, AFR 53-19 is also under revision. It should be published in the near future.

Currently we are conducting two classes per year beginning in February and August. Each class is composed of approximately eight engineers and navigators. During our screening board in December 1973 for the August 1974 class, we considered five navigator applicants, of which one will be selected for attendance in August.

Any publicity or assistance you are able to give us in soliciting applications will be appreciated. Direct any additional questions to Capt Bill Fields, telephone AUTOVON 350-2762.

Paul N. Driggers, Jr., Capt, USAF
Executive Officer
USAF Test Pilot School
Edwards AFB, California

Here's your publicity. See article this issue "Test Navigator/ Flight Test Engineer Career?" We have also inserted some of this information into the Senior Staff Navigator Course block of instruction, "The Changing Role of the Navigator." It looks like an excellent opportunity for outstanding navs. Wish I were young enough to apply. By the way, Captain Mike Billick from Mather was selected to be the August 1974 attendee.

Ed.

THE NAVIGATOR

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This issue's cover depicts the military's largest aircraft in one of its initial stages of testing, formation flying at low level. See inside story for what it's like to transition into the C-5 directly from basic Navigator Training.

Navigators at Blue U.

Major Richard HERMAN
USAF Academy, Colorado

Gather a group of navigators together for whatever reason and it is inevitable that the discussion will eventually turn to career development. Comments on what constitutes a "good" rated supplement assignment will cover most of the job spectrum, but for some reason the conversation seldom leads to the possibility of instructing at the Air Force Academy. The purpose of this article is to express a genuine feeling about one of the more desirable rated supplement assignments in the Air Force.

No treatise of this kind can really place the importance of a rated supplement assignment in its proper perspective. Like most officers, navigators view themselves as highly competent professionals who must personally evaluate all the pros and cons of any career broadening assignment before making a decision. Many astute individuals never hesitate to point out that promotions for a navigator hinge largely on what he does outside the field. Others describe the recent trends that indicate navigators will probably be allowed to command operational units in the future and change all this. Then the pessimists paint a somber picture, mumbling of inertial nav systems, Omega, black boxes and other inhuman devices. But if reason prevails, most will agree that navigators have the same problem common to all officers; namely, to find the "right" assignment for career broadening.

In fact, there is no "right" assignment to pursue outside of navigation for career development. Whatever the individual's choice, it must meld with his talents, personality and specific desires. An assignment should accentuate the individual's strengths, knowledge and education. If it is also challenging and interesting for the person involved, so much the better. When all factors are considered, one guiding principle does emerge; any assignment for career broadening is an individual thing. Within this framework, an assignment as an academic

instructor at the Air Force Academy should be considered by some navigators.

The Academy has a very unique environment due to its mission, staff and location. The mission of the Academy, a major command, is to "...provide instruction and experience to each cadet so that he graduates with the knowledge and character essential to leadership and with the motivation to become a career officer in the United States Air Force." When this mission is evaluated in terms of the cadet wing, a very select group of young men, it becomes apparent why the faculty and entire staff must, in turn, be unique.

It is difficult to describe a "typical" cadet. A general profile would reveal that each is intelligent, healthy and has a record as an achiever. In this aggregate, they form the cadet wing of over 4000 individuals that must be taught and exposed to the academic disciplines that are fundamental to future Air Force officers. It is to these individuals that the instructor must be oriented while at the Academy.

The basic requirements for an instructor call for an intelligent, highly motivated individual with at least a master's degree and three years operational experience. Considering the intellectual capabilities of the cadets, part of an instructor's academic armor is a fair degree of intelligence. But above all else, each instructor must be personally committed to an Air Force career. With one exception (a foreign service officer from the State Department), the faculty is composed of military personnel. There are a few Army, Navy and foreign officers on the staff, but most are Air Force "blue suiters." The logic behind the military faculty is straightforward; the best way to motivate is by example.

The matter of a master's degree will be covered shortly, but first the item of operational experience. It all ties back to motivation because, for most of the faculty, this is not a career assignment in itself but a four-year tour. An officer becomes personally committed to an Air Force career due to his own experiences. And it is the combination of commitment and experience that gives motivation credibility.

The minimum educational requirement for an instructor is a master's degree. To be assigned to the Academy with three years experience means that the individual had attained his degree before coming on active duty or through off-duty education. While selection standards are rigorous, if your qualifications are right and a need exists within one of the departments that teaches your academic discipline, the Academy will send you back to school for your master's under an AFIT assignment. Many variables enter in, such as your undergraduate degree and major, grade point average, acceptance into a graduate school, OERs, and personal bearing.

At this point, the type of officer that the Academy is seeking should be clear. The faculty is a relatively exclusive group of officers that undergoes careful scrutiny before selection. Further, it appears that a large percentage of "fast burners" are assigned to the Academy. Most of those that have been promoted from below the primary zone did not make their early promotion due to an Academy tour, but because of what they did prior to their assignment to the staff. It is difficult to break out from such a group for early recognition, but there are ways and unique opportunities. Publications and special summer research projects offer some avenues.

So far, nothing has been advanced that applies to navigators as apart from other Air Force officers. One of the desired goals of the Academy is to maintain a faculty of which 50 percent are rated. This goal relates back to career motivation with "blue suiters" as the prime example. Due to a variety of reasons, only 32 percent of the present faculty of approximately 570 are rated, and only seven percent of the faculty are navigators.

Once assigned to the Academy, a navigator can remain involved in flying or he can simply meet annual requirements. If the latter is preferred, the 4600 ABW at Peterson Field schedules regular navigator proficiency flights in T-29s. During the winter and fall, the flights are at night. Spring and summer proficiency flights are usually scheduled during the day. Some navs escalate their level of involvement and check out as Instructor Navigators for the section.

The second way to meet flying requirements and to stay involved with flying is to work with the Navigation Division at the Academy under the Commandant of Cadets. The Nav Division offers a course in navigation that involves a series of five flights on which the cadets actually navigate. The objectives of this course, Nav 470, are "to prepare and motivate cadets for rated flying training," and impart"...an understanding of the responsibilities and requirements of a rated specialty for those cadets who will pursue a non-rated career field." In one semester, the cadets are exposed to DR, Map Reading, Radar, Celestial, and flight documents. They achieve a very creditable level of knowledge in the basics of navigation in a short time. Part of the success of the program is due to the favorable cadet/ instructor ratio. The Nav Division relies on navigators on the faculty to give them the depth needed to maintain the ratio in trainers and on flight missions. It is a rewarding way to fly, for it is one more way to demonstrate what a rated, professional officer does.

A secondary, mostly unspoken concern over flying centers on rated/ non-rated relationships and attitudes and its corollary, nav-pilot rivalries. Fortunately, the professional maturity of the staff precludes the formation of any schism along these lines. Some good-natured kidding is prevalent and a few individuals enjoy trying to perpetuate these traditional rivalries. But it is extremely difficult to maintain any illusion of unique superiority given the talent and wide variety of experience found throughout the faculty.

The focus of an instructor is, above all else, the classroom. Each class section is relatively small, usually ranging in size from 15 to 20 cadets. The sections are kept small to permit interaction between the instructor and each cadet. Because the academic load is intense and of a high quality, the instructor must be aware of the progress of each cadet. In most cases, he can do this in the classroom or through extra instruction, which is a one-on-one tutorial session. A comprehensive evaluation of the faculty would reveal that the tradition of the soldier-scholar is alive and well at the Academy and producing a quality of instruction that is indeed commendable.

Occasionally, the subject of classroom academic freedom arises. While this author has never been exposed to a comprehensive definition of the term, any subject that falls within the individual instructor's academic or professional competence is open for classroom discussion. However, it is the instructor's responsibility to present all the relevant facts that bear on a controversial subject and to conduct a balanced, objective analysis.

Outside of the classroom, an instructor devotes part of his time to extra instruction and counseling. The counseling can be informal and usually occurs when trying to help a cadet pinpoint an academic problem. A formal, definitive role involves acting as a cadet's academic advisor, where the instructor helps the cadet structure his program. Many of the academic departments sponsor cadet clubs for conducting field trips and special activities related to their discipline. Again, this calls for faculty participation and guidance.

Normal working hours for an instructor are 0730 to 1630, Monday through Friday, with leave periods paralleling the cadets' vacations during Christmas, spring break and summer. Since many instructors are involved with cadets through the activities already mentioned, the hours are often longer and a rigid schedule is impossible to adhere to. When these additional activities are added to the time required for lesson planning, grading and maintaining academic and professional currency, a very full schedule emerges. While the workload may be full, the pressures of short suspenses and operational requirements are largely missing. The personal experience of the author has been that he is not working any less, just enjoying it more.

The advantages for professional development at the Academy are unique and equalled in few assignments. Because it is both an academic and a military institution, a variety of famous personalities are invited to speak. Former speakers have ranged from columnist William F. Buckley, Jr., to General Walters of the CIA. Briefings are regularly scheduled on the full spectrum of military topics, from personnel to the F-15 and B-1. Various opportunities arise to participate in seminars on many different topics. Special projects of both a long term and short summer research type are available for exploration. Some of these projects have added significantly to the success of new weapon systems or managerial techniques. In short, the opportunity for professional development based on individual skills and interests is outstanding.

The chance for academic development also exists. Approximately one-third of the faculty hold PHDs and many have been earned under academy sponsorship through AFIT. Once a PHD is attained, it is possible to become a tenured professor and devote a career to the Academy. While undoubtedly benefitting the individual, this also helps the school by insuring accreditation and academic quality while concurrently providing a degree of continuity in instructor personnel.

No discussion of Academy instructor duty would be complete without mentioning the physical plant and the surrounding area. The Academy is Colorado's foremost single tourist attraction and receives approximately two million visitors each year, the majority during the summer months. The cadet area is a showpiece of the Air Force and, in itself, is an impressive architectural achievement. The backdrop furnished by the front range of the Rockies, Pike's Peak, and the western edge of the Great Plains, completes the esthetic qualities of the institution. The area has been called the climate capital of the world, and while some might take exception to that description, the prevalent climate is semi-arid and does not experience great extremes of heat or cold.

The city of Colorado Springs is adjacent to the Academy and community relations are excellent. Many of the faculty live off-base and have found a full range of homes, services, and entertainment available. For those who enjoy skiing, camping, hunting, fishing or hiking, the surrounding area offers the chance to pursue these interests. The Academy's inter-scholastic program is extremely inviting and where else in the Air Force can a navigator buy season tickets for college football and expect to attend every home game?

Now how does one go about planning for an assignment to the Academy? The best way to approach the problem is to consider all the factors and then work backwards. In order to maximize career development, it is assumed that the ideal time to return to operations is somewhere around the twelfth year of service. With the Academy tour being four years, you would then have to allow two more years and enter graduate school at approximately the six-year point. Lead time for application, selection and processing must come between the fifth and sixth years. It should be apparent that a navigator must start considering an Academy tour very early in his career if he is to satisfy this suggested time frame.

On reflection, there is no way to adequately summarize a tour of duty as an academic instructor. The assignment is intellectually demanding and requires a deep personal commitment to the Air Force. It is certainly not "right" for every navigator, but for those with the proper qualifications, it can be extremely rewarding.

An army of deer led by a lion would be better than an army of lions led by a deer.

Old Latin Proverb

Editor's Note: With the controversy about Title 10 soon to reach a head, it is conceivable that more and more navigators will be selected for command positions. In the first half of this year, five Major navigators left Mather to fill squadron commander positions at Keesler, Lowry and Chanute. Operational flying units may be next, and some navigators could find themselves thrust into command positions almost overnight with little or no formal training in leadership principles. Colonel George A. Dugard, Vice Commander, 320th Bomb Wing , Mather AFB, and Colonel George Holt, Deputy Commander for Operations, 321st Strategic Missile Wing, Minot AFB, offer the following suggestions for both incumbent and aspiring commanders. Navigators take note! You may soon be this leader they are alluding to.

EFFECTIVE LEADERSHIP

Colonel George A. DUGARD (Command Pilot)
320th Bomb Wing
Mather AFB, California

Colonel George HOLT (Master Navigator)
321st Strategic Missile Wing
Minot AFB, North Dakota

Any organization is simply a structure designed for the more efficient use of human and material resources to achieve specific goals. It has a purpose that is usually stated in formal language and tends to be controlled by this purpose. Every organization, be it military or civilian, tends to develop a hierarchy and has a definite chain of command with a leader at the top of the structure. The leader of an organization has the responsibility to maximize the efficiency and the effectiveness of his organization. He does this by motivating people toward the most important function of an organization, goal achievement.

Goal identification means insuring that people within an organization know specifically what to do, why they are to do it, and how their specific task relates to the overall mission. Communication, then, is absolutely essential in realizing the end result. If the mission statement, or purpose, is abstract, then working-level goals must be developed. For example, an abstract mission statement might read, in part "...to provide for the deterrence of nuclear war." A working-level goal, however, might read "...to provide security for the SAC alert area so as to ensure the safety of aircrews and aircraft which will contribute to the continuing deterrence of nuclear war." Each person can now identify with this working-level goal and recognize that his role involves not just an individual effort, but can also see how it affects the successful operation of the entire organization. A leader must make the goals of the organization become the goals of the individual. He must get his people involved by having them actively participate in the development of working-level goals and the formulation of job descriptions. This unquestionably helps people identify with the goal and their involvement becomes a personal commitment.

The group decision-making process serves two vital functions. First, the quality of the decision is generally better because it draws on the talents and resources of more than one person. A decision formulated by the troops, the First Sergeant and the commander also helps to instill confidence in the chain of command. There is no one as important to an organization composed primarily of enlisted personnel than a First Sergeant. This must be a strong position, filled by a person who is always available, loyal to the commander, and trusted by all the personnel in the organization. Given all the essentials of a good commander and blessed with a strong First Sergeant who is "tuned in," success is now dependent only on proper implementation of leadership through the

ranks. The First Sergeant will insure that all supervisors will pass the word and that they will actively participate in the total group decision as representatives of their men.

Secondly, each member fully identifies with the decision and feels highly motivated to execute it to the best of his ability. The leader must recognize, however, that indecision may do more harm than good and could generate negative motivation. Under certain circumstances, when the group decision process becomes unproductive, he may have no choice but to make the decision himself. In this event, he must look into his chain of command and find the right people to promulgate involvement and support for his decision. The decision making process in a predominantly enlisted outfit, such as a maintenance squadron, can be shared to a certain extent when the decision affects matters that contribute to unit morale. An example would be an airman's council or active rap sessions on the needs of an outfit. This would also apply when the decision involves a unit picnic, a flight line procedure, or any item that leads to active involvement on the part of all. Empathetic understanding can be gained by keeping all channels of communication open and being receptive to the problems of the people. An open-door policy, getting with the men on the job, and encouraging consultive participation at all levels of command help keep these communications channels open.

Individuals thrive on self-esteem and pride in a job well done, but they must believe that the job is worthy of their efforts. It is rather significant that, during missions with clearly defined goals, even the most difficult of objectives is actively pursued by all. An excellent example of this lies in the performance of the B-52 squadrons during the Christmas of 1972 raids over the heartland of North Vietnam. When it was announced where the raids were going and the obvious significance of them, crewmembers were volunteering to fly. Individuals who were off status due to physical ailments were seeking competent medical authority at night in order to get back on status. A goal was there and was identified as one that the vast majority wanted and could identify with. The "go" spirit of the crews was loudly echoed by the efforts of everyone involved in the operation. Support personnel performed in a manner possibly never seen before. The methodical, everyday activity of Andersen and U-Tapao was suddenly permeated by an electricity that generated supreme efforts from mechanics, bakers, bus drivers, clerks and everyone else who identified with the goal. It was obvious to all that a job had to be done and they were going to do it. The difficult but identifiable goal resulted in job accomplishment being the prime consideration, even at the expense of personal sacrifice.

After providing direction in the form of goal identification, the commander must instill within his people the desire to work towards the goal in the most effective, efficient and, if necessary, expeditious manner possible. The nature of the goal and the time allowed for achieving it determine the type of motivation to use. The "butt kicking" technique of a General Patton may not be as effective as the participative management technique of a General Motors. On the other hand, the "good guy" approach could prove disastrous when the situation requires an immediate decision. Further, people may literally *demand* the authoritative type leader when the nature of the goal provides much of the motivation for achievement, e.g., when failure to achieve the goal would mean grave danger for all concerned. Therefore, the style of leadership or the type of motivational techniques employed must be tailored to the type of organization and the nature and urgency of the goal. This qualification is important and necessary to keep in mind when considering the following motivational factors.

Reward and punishment are effective motivational and corrective tools but must be used judiciously. The commander must make an effort to identify those people, or more importantly, those groups, that have performed exceptionally well and reward them accordingly. He must be careful, however, that he does not create envy in an individual's peers. The reward must be meaningful to the recipient and must be respected and appreciated by his peers. Official recognition might well be a source of deprivation or embarrassment to an individual if his co-workers ridicule or ostracize him. For instance, the "Airman of the Month" award may do more harm than good to the individual's self-esteem if the award is meaningless or farcical. Generally, group reward is more important and has more impact than individual reward because it breeds team spirit. The leader must encourage groups and individuals to seek ways to perform their tasks more efficiently for the good of all, and then reward them for their efforts as a group.

Punishment is an important correctional device. If an individual does wrong, purposely and with malice, then punishment should be swift, commensurate with the offense, and publicized. Fairness on the part of the commander is extremely important in this area. Once again, an "aware First Shirt" will keep him apprised of the mood of the men; he'll know because he communicates. He should be able to provide advice as to when to withhold severe reprisal and when to mete out heavy penalties. His judgement will play an important part in the effectiveness of a commander, but the commander, as a leader, is the final authority and must be ready to take other action if the First Sergeant's contact is stinted or too authoritative. In

other words, if the First Sergeant's experience fails, the commander must recognize it and let his own take over. Callousness is not a substitute for experience, nor is age a substitute for maturity. Wrong-doing on impulse or because of immaturity should be given a second chance and, hopefully, maturity and experience will ultimately temper impulsiveness.

Every leader should recognize and capitalize on individual motives such as self-fulfillment, status, recognition, approval, acceptance, power, and the desire to undertake important tasks. Curiosity, creativity, and the desire for new experiences also play an important part in individual motivation. Once a commander identifies any of these characteristics or needs in any of his people, he should do his best to match the man with the job that will satisfy the need. An individual who is gaining need satisfaction through his job is most likely a motivated, productive individual, and motivated, productive individuals lead to closely-knit, high-achieving organizations.

Measurements of organizational performance provide important feedback for a leader. Objective measures of performance and subjective measures of attitude toward management should be used primarily for group or self-guidance rather than for superimposed control. The leader must be a sincere, active listening post. He should let it be known among his subordinates that he is interested in knowing their problems and wants to help them solve those problems. He also wants to know if his management methodology is working and, if not, how it can be improved.

Participation by a commander and his staff in all organizational matters is also a necessary ingredient to motivation. In combat, the most respected and effective commander is the one who not only leads, but experiences the rigors, hardships and strain of the combat environment. His men feel they can share their fears and anxieties as well as their pleasures in performance because he knows "where it's at." They further respect his knowledge and leadership for he has proven himself and has shown that he is capable of doing what he must ask others to do.

In summary, a leader must give his people direction (goal identification) and then inspire them to proceed in that direction (goal motivation). But goal identification and goal motivation, even when understood, mean nothing unless they can be applied effectively. This is achieved by communication between the leader and the people he leads. A leader must possess job knowledge and personal motivation for goal achievement, as well as self-confidence and integrity if he expects to come across effectively to his people. Empathy, the ability to perceive the situation from the eyes of his people, enables the leader to communicate on their wave length. Persuasion and joint participation in an effort to achieve a common goal will get the job done and ultimately improve the effectiveness and efficiency of the organization in the process.

Being a commander is obviously not a popularity contest, but it certainly helps if your men believe in you, the unit goals, and the combined abilities of all of you to attain those goals.

Captain David M. HORNBAKER
366th Tactical Fighter Wing
Mountain Home AFB, Idaho

"Sixty knots, NOW. One hundred knots, NOW. Engine instruments good. Gear's up. Flaps moving. Slats moving. First heading 258 degrees."

The preceding dialogue is not what one would consider typical navigator jargon, but in this day and age, it is fast becoming more common. When a navigator from Mountain Home AFB straps on an F-111F, he is expected to be much more than a basic navigator. His office is right up front, next to the Aircraft Commander, and that in

itself should give you some insight into his responsibilities. Fighter pilots call him a "WIZZO" (W.S.O. or Weapons Systems Officer) and fondly refer to the right seat operations as "the magic" of the F-111F.

For a wizard, the Wizzo is not really very mystical nor can he employ a sorcerer's techniques to accomplish something considered to be impossible. He does, however, possess skills and sophisticated equipment that help him to conquer the previously impossible, insofar as aviation is concerned. You can call him Wizzo for short, but never underestimate his powers.

Not too long ago, Air Force policy toward navigators changed dramatically. Unrest among pilots occupying both seats of two-seat fighters and the ambitions of navigators to fly fighter-type aircraft inspired the Air Force to initiate a program that placed navigators in the rear seat of F-4s, F-105F Wild Weasels, and the right seat of F-111s. Since that decision was made, Wizzos have definitely found their place in "fast movers."

All Air Force navigators have at least one primary responsibility in common, and that is the task of getting from point A to point B safely. The records show that most hack the program fairly well. But, when a Wizzo straps into an F-111F, his primary responsibility is overshadowed by operation of the weapons systems and navigation ultimately becomes a smaller portion of the big picture. The importance of getting from A to B has not changed; it's just that the sophisticated navigation equipment available to the WSO, as we shall see, has made the task much easier than ever before.

The term "Systems Operations" involves a whole new concept of gyros, electrons, pulses, armament preflight and "switchology," communications, bombing, electronic countermeasures, radar homing and warning, and radar. There have been navigators in the past who have been specialists in some of these areas, but few have ever had the opportunity to have simultaneous control of all these systems. In the F-111F, all these systems and many more are within easy reach of the Wizzo.

The F-111 "F" model, currently based at Mountain Home AFB, Idaho, is flown exclusively by the 366th Tactical Fighter Wing of the USAF Tactical Air Command. The mission of the 366th TFW is to train aircrews and to maintain proficiency in the more specialized and technically sophisticated role of precision, low level interdiction bombing. Proficiency demands that we be able to achieve our mission either at day or night, in adverse weather conditions, and in sophisticated, hostile environments.

All phases of F-111F WSO training are conducted at Mountain Home AFB. The entire course is approximately six months long and integrates academics, flying, and simulator training. The student learns about aircraft general, emergency procedures, operating procedures, Inertial Navigation System (INS) alignment, the digital computer complex, the Navigation Display Unit(NDU), the Computer Control Unit (CCU) and the attack radar set. A simulator mission will challenge the student's knowledge prior to his first actual flight. The F-111F simulator, which was recently installed at Mountain Home, is a tremendous aid to students and an excellent teaching device since the instructors can instantaneously detect and correct improper procedures or poor techniques. At different stages throughout the course, each student also receives follow-on training on the Terrain Following Radar (TFR), weapons, Radar Homing and Warning (RHAW), and penetration aids.

After a few weeks of academics and a simulator ride, the student is ready for his first flight. The mission profile calls for the student to practice what he has learned so far, and to familiarize himself with the flying capabilities and general characteristics of the aircraft.

"Squirrely electrons" and numerous checklist procedures dominate the student's attention as he ascends the ladder for his first F-111F flight. After bumping his head on the canopy latch, the aspiring new Wizzo accomplishes the seven required steps in the "before entering cockpit" check and then researches the aircraft forms with the AC. The aircraft walk-around inspection is accomplished by both the AC and Wizzo. After a few flights in the aircraft, the average Wizzo becomes quite proficient at

the F-111F preflight and can accomplish the exterior preflight every bit as well as his pilot. He really begins to get the feel for the importance of the crew concept and just what it means to support each other's actions.

After both engines are running, the Wizzo applies power to his computers. Present position coordinates to the nearest hundredth of a minute, field elevation, and local magnetic variation are typed into the Computer Control Unit. The Inertial Navigation System, which is similar to the Apollo spacecraft's INS, uses this information to resolve the aircraft position down to feet. The Converter Set changes the analog inputs to digital outputs and transmits the digital pulses to the General Navigation Computer (GNC) and the Weapons Delivery Computer (WDC). Both of these computers, with their protected and unprotected memories, allow the Wizzo to program steering information, update fixes, bomb, align the INS inflight, maintain system fault reporting, utilize the tape load of his mission, and many other things. While the INS is aligning, the Wizzo either types in a program of destinations, offsets and fixpoints he wishes to use or he verifies the programmed destinations that were tape loaded before his arrival at the aircraft.

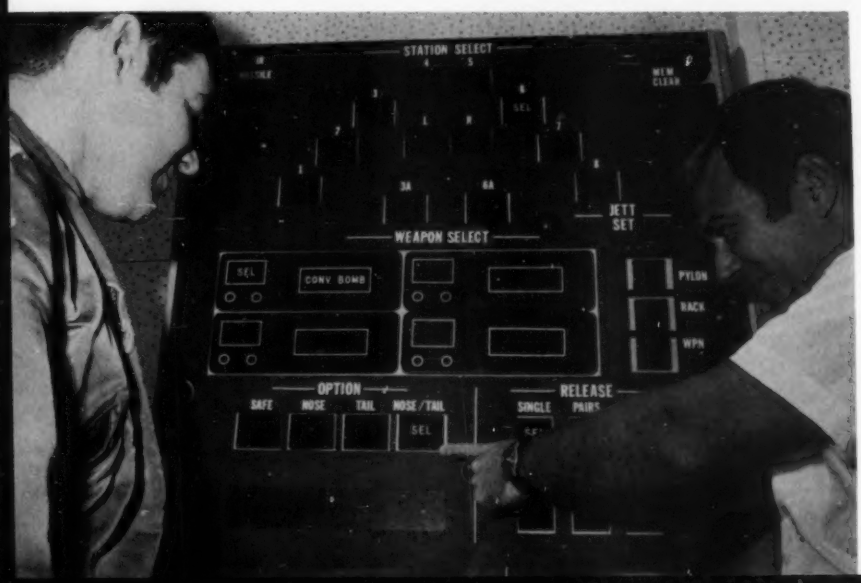
On future missions, he will program the weapons delivery panel by selecting a station, weapons cassette, arming option, release option (if applicable), and delivery option. Additionally, a simulate switch is provided that permits loading of practically any weapon on any station.

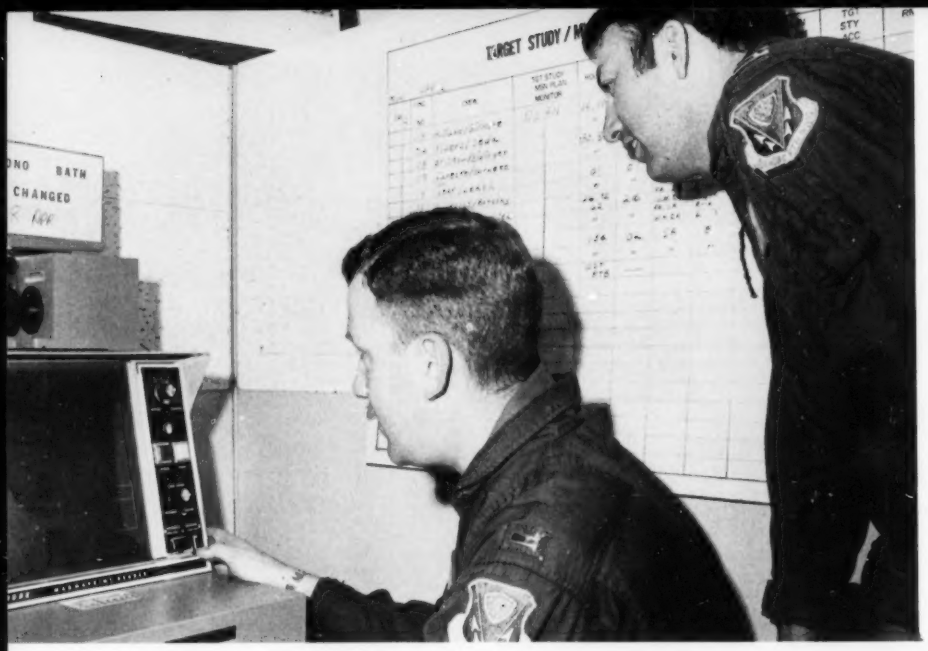
Moving his hand down the console to the CCU panel, the Wizzo must now program the weapon location and supply the identification number of the weapon to the protected memory of the computer. Manual bombing ballistics are also typed in. This provides an alternate means of delivery and gives the Wizzo the option of using manual ballistics if he determines them to be more accurate. For a radar delivery, if he is dropping iron bombs off a suspension rack rather than practice bombs from the SUU 20 dispenser, he will also program, through the computer control panel, spacing and number of releases.

Nearing the end of his "power on" checklist, the RHAW and Penetration Aids equipment are preflighted. The Wizzo also interrogates the INS, through the use of "Octals" (typed in numbers which check on the status of the system), to verify a good alignment. With a flashing green align light, he places the computer control function switch to NAV and informs the AC that he is ready to taxi. Surrounded by all that sophisticated equipment, he feels more like Buck Rogers than a Weapons System Operator.

After departing the quick check area, the crew accomplishes the runway checks. With the brakes on, both TF 30 P 100 engines are run up to 3rd stage afterburner and all instruments are checked. At brake release, the throttles are advanced to full afterburner and the 40-ton aircraft virtually leaps off the runway in less than 3000 feet. Even former F-4 Phantom and F-105F Wizzos are impressed with the available power in the F-111F.

All outside changes are immediately sensed, recorded, "massaged" by the Kalman Filter,





and applied to the digital readouts of the Navigation Display Unit (NDU). (The Kalman Filter is a filter in the GNC which analyzes all inputs to the system, and either accepts a portion of the inputs or rejects them as invalid.) The radar crosshairs are already sitting on the first destination and the visual information readouts, which are continuously changing, include true wind and direction, true airspeed, groundspeed, present position, and miles to go. With the advanced avionics in the F model, the Wizzo is free to keep his eyes outside the cockpit, checking for other traffic or threats. It requires only an occasional glance inside the cockpit to monitor the equipment.

Crew coordination is paramount. The crew concept starts long before actual takeoff. The crew flight-plans the route, checks control times, discusses equipment failures, considers alternate releases, and briefs the mission. They must also consider the worst conditions that they may encounter along their route. Inside the cockpit, the AC and Wizzo must constantly communicate and support each other in every critical phase of the mission. Nothing can ever be left to chance.

Imagine for a moment the following mission to a Radar Bomb Scoring (RBS) site. The crew has been fragged to destroy one grain storage elevator. After dropping off the KC-135 tanker, the AC and Wizzo complete the TFR checks, sweep the wings back, engage the auto TF (i.e. hands-off terrain following) and descend into the pitch blackness.

It is night and raining. The weather briefing predicted thunderstorms in the target area, and for once, the briefing had been 100 percent correct. To make matters seem even worse, the aircraft is being bounced around by turbulence while you use TFR to establish your altitude at 100 feet above the ground.

Your AC crosschecks his terrain-following radarscope with your radarscope. You inform him of all obstacles and he acknowledges your statement as he sees them march across his scope.

The F-111F automatically sequences at the initial point and races toward the target. You check the fuel, and recheck the weapons panel. You discover the timing is 15 seconds in error. No sweat! For a 600-mile mission to the target, 15 seconds error is acceptable.

While the AC transmits pertinent data to the range, you select "RADAR BOMB" on the CCU and attempt to visualize the radar prediction you studied hours before. Of course, you also carry predictions in the cockpit as a mind jogger. Seconds now click off on the two individual "miles/ seconds to go" indicators.

You are finally over the ridge that was blocking target area return. The first offset is the water span of a bridge; it is right there as Target Intelligence predicted. The second offset is not showing at all, and is probably obscured by rainshowers and thunderstorms. By using the pointer system taught in UNT, you positively identify your target and go target direct. The crosshairs jump to the general target return.

Your AC calls "60 seconds to go—Master arm ON." If you have meticulously refined your crosshairs on the selected offset, the target building is easy to break out from the surrounding complex.

"Moving the crosshairs slightly left and forward," you inform your AC. The F-111F follows automatically.

"Ten seconds to go," states your AC as he flips the tone switch forward and depresses the bomb release button. You make one final hairline adjustment. All down final run-in, your hands have been moving automatically from the attack radar tracking handle to the gain and to other refining knobs. The target has been reduced to such a fine point that there is no doubt in your mind as to where the weapon would go.

Suddenly, there is silence. The tone stops signaling bomb release and the F-111F automatically sequences to take you home. Your bomb run is over.

The 366th Tactical Fighter Wing recently had a Tactical Air Command Operational Readiness Inspection. One squadron, the 391st Tactical Fighter Squadron, met or exceeded TAC standards in all events. The following message was sent from General Dixon, Commander of Tactical Air Command, to the 366th Tactical

Fighter Wing, and to the 391st Tactical Fighter Squadron:

"Standards are made to be beaten by the professionals. The 391st TFS met or exceeded TAC standards in all events during the recent Operational Readiness Inspection."

The top crew in the 366th TFW was also from the 391st TFS. On two successive night missions, using the radar for bombing, they dropped perfect scores. Their miss distance was zero feet!

Yes, the F-111F is one super-sophisticated aircraft. Its avionics are a navigator's dream, the radar is superb, and the flying is challenging as well as very rewarding. No matter how often a Wizzo flies in the F-111F, the aircraft will never cease to be amazing. It is a balanced weapons system that presents a capability never before available with fighter aircraft. And there is no doubt in anyone's mind that the Wizzo, who is definitely here to stay, has helped make it the system that it is.

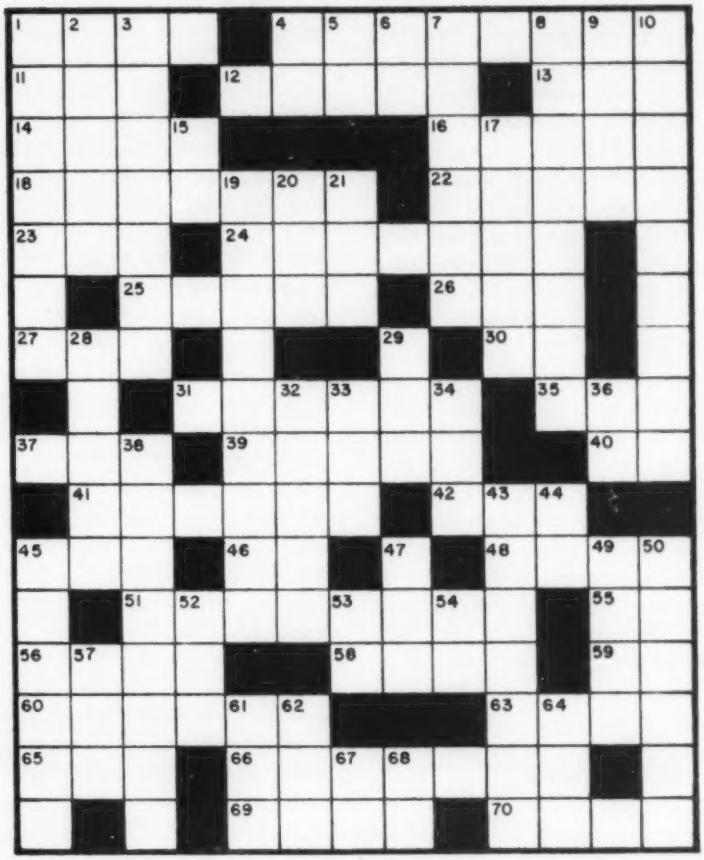
Navwords

ACROSS

1 Lock gyro in place
4 Heat seeker
11 Formal inspection
12 Small, misshapen dwarf
13 Salutation
14 Ancient farce
16 Point below observer
18 Smooth, round stones
22 Banishment
23 A King of Judah
24 Pain in the ear
25 Pertaining to moon
26 Training in equal opportunity
27 Signal for help
30 Myself
31 Rain cloud
35 Static Air Temperature
37 Lion constellation
39 Crownlike headdress
40 Storm troopers
41 Type of range
42 As low as you can go enroute
45 Aircraft parking place
46 Boss of operations
48 Constellation meaning cross
51 Type of navigation
55 Symbol for rubidium
56 Established shipping route
58 VOR, in all directions
59 South America
60 Radio interference
63 Flight. . .
65 Crew rest pastime
66 Different
69 Put aircraft on ground
70 Airspeed around corner

DOWN

1 Direction measuring instrument
2 Constellation between Pisces and Taurus
3 Gyro supports
4 Navigation instructor
5 Character in James Bond novel
6 Type of modulation
7 Go back on promise
8 Emits from center, like VOR
9 Wickedness
10 Worthless persons
15 In chemistry, erbium
17 Statement accepted as true
19 Meridian
20 When you think you'll get there
21 Rescue's big job
28 Type of radio navigation
29 California's Big . . .
32 Ursa's smaller bear
33 Not good
34 Launched from ground
36 Like
38 Vertical one of rectangular coordinates
43 When moon obstructs sun
44 In the year of the reign
45 Loran signals
47 That guy
49 . . . Major and Minor
50 Radio frequency bands of 5,200 to 10,900 MHz
52 Fisherman's tool
53 Ho Mo . . .
54 Article
57 When you got there
61 International Date Line
62 Intelligence collectors
64 Permit
67 Short for Vietnam
68 Forms past tense



NAVWORDS answers on page 24.

C-5A: MAC'S BIG

1st Lt John A. MOORE, Jr.
22nd Military Airlift Squadron
Travis AFB, California

If you are coming up for reassignment to a cockpit job, graduating from Undergraduate Navigator Training (UNT), or just looking for a change into another weapons system, it would behoove you to seriously consider the Lockheed C-5A *Galaxy*. While a student in UNT, I was fortunate enough to be able to select the C-5 and was ultimately assigned to the 22nd Military Airlift Squadron at Travis AFB, California. Before this assignment, my only navigation experience was approximately 190 hours in the venerable, trustworthy T-29, an outstanding trainer, but not exactly the vanguard in modern navigation equipment. I can honestly say that, since I left UNT, the past year and a half has been full of unique and rewarding experiences that I could never have envisioned just a few short years ago and I'd like to share them with you.

Altus AFB, Oklahoma, my first stop in the upgrade process, is the home of the 443rd Transitional Training Unit (TTU), the C-5 and C-141 school for pilots, navigators, engineers and loadmasters. The school has a very well planned curriculum and employs, as instructors, some of the Military Airlift Command's (MAC's) most experienced crewmembers. All of the instructors have flown the MAC line at one time or another and teach from actual rather than vicarious experience.

The first seven days of the school are devoted to basic instruction in MAC policies, procedures and forms—the MAC way of doing things. Both C-141 and C-5A prospective navigators attend this phase of training together and then branch out to instruction in their respective aircraft. The actual C-5 school consists of 12 days of academics and 12 days ot simulator training that includes one flight in the C-5. The academic portion includes flight planning, fuel planning, range control, equipment operation and a multitude of other areas that eventually become second nature to every qualified MAC navigator. After academics, you get introduced to the C-5A simulator, a multi-million dollar machine that can realistically duplicate the majority of systems and conditions that you must cope with inflight. It has all the navigational systems—the computers, LORAN, Attitude and Heading Reference Units (AHRUs), Heading and Attitude Monitor System (HAMS), Inertial Measurement Unit (IMU) and the Multi-Mode Radar. Many of the computers' Special Data Routines, including the celestial program, are also available in the simulator. The best feature of this electronic marvel is that it allows you the opportunity to learn how to cope with equipment malfunctions and simulated emergencies before actual flight in the aircraft.

The C-5 school tries to provide each new navigator with 12 simulator flights and approximately 43 hours of simulator seat time before graduation. The real highlight of the training, an actual flight in the C-5, is programmed to come between the third and fourth simulator missions. This is by far the most exciting and impressive event in the whole training package. The sheer enormity of the C-5 makes one wonder just how it gets off the ground. But it does, and without gobbling up the miles of runway that I had previously envisioned. Overall, I left the 443rd TTU with what I considered to be an excellent working knowledge of aircraft systems and navigation procedures. And the professionalism and expertise exhibited by the instructors at Altus gave me the impression that I was going to a Command that expected nothing but the best from its navigator force.

Soon after signing in at Travis, I drew the remainder of my flying gear and associated equipment, filled out the forms for the passport and line badge required for all airlift missions, and started my local ground training with an instructor navigator assigned to monitor my progress. We immediately began to review all the material I had been exposed to at Altus plus a lot more. I learned about Ocean Station worksheets, AIREP forms, comprehensive emergency procedures, fuel planning and a host of other requirements that are SOP in the MAC system. Once each week, the available navigators met and thoroughly discussed the problem areas encountered with equipment during their flights, as well as new techniques, changes and procedures. Occasionally, a civilian Technical Representative presented an in-depth review of selected pieces of avionics equipment and answered any questions about the C-5's complex navigation systems. The entire navigation section benefitted from this detailed cross-feed of information, and particularly a new guy like me who obviously had so much to learn and so little to contribute at this stage.

After completing my ground

training program, I felt well prepared to take my first operational flight in the C-5. I anticipated a normal overwater mission but was scheduled for a Tinker turn-around instead. Even a stateside mission can be very productive when you're still a brand new guy. I learned much more about flight planning, fuel planning and some of the operational aspects of our systems, especially the weather radar. I felt much more confident with my equipment and personal capabilities after that first flight, and felt that it prepared me well for my first "westbound" mission.

And a week later, it came. I departed on an airlift mission to Nakhom Phanom AB, Thailand. I got more than my share of seat time during that flight and the practical experience I gained was every bit as valuable as the months spent at Altus and on the ground at Travis. I was pleased to see that the actual experience I gained beautifully complemented everything I was taught in the classroom and simulator.

After approximately three months, I successfully passed a check ride and was upgraded to a fully qualified MAC navigator. We were flying augmented then (two navigators per crew), so I always flew with more experienced navigators and had sufficient opportunity to observe and master their individual techniques. If I could attribute my expanding knowledge to any one thing, it would have to be the total willingness of the other navigators to share the full spectrum of their knowledge and experiences with me.

As I became more proficient in the aircraft, I quickly became aware of the great deal of technological skill that went into the development of the C-5's systems, as well as the equipment required to repair them. The interrelated systems are vastly complicated and require a great deal of diligent book work for the new navigator, not only to learn interface relationships but to post the many changes that pertain to equipment update. As previously stated by many of my associates with extensive navigation experience in MAC, the C-5 navigator has truly become a systems operator.

It is not my intention to develop a technical article on the navigation systems on the C-5, but I would like to provide you with a cursory look at some of this new generation of equipment. The C-5 navigation systems are many and varied and definitely do ease the task of navigation when they are operating properly. The IMU, for example, is an extremely accurate instrument with a factory rated error not to exceed more than 1.5 nm per hour. This high degree of

accuracy provides a more accurate navigation capability than ever before available in MAC aircraft and enables us to transit oceanic routes in close proximity with civilian airline traffic. The data from the IMU is fed into the Primary and Auxiliary Computers and is available to the navigator on an Indicator Panel display. And if either of these computers is inoperable, the back-up capabilities of the other allow us to effectively accomplish the mission with a partially degraded system.

The C-5 Doppler equipment provides an alternate drift and groundspeed input to the computer systems. This allows the computer in control to crosscheck the information against the IMU and determine the best available tracking information. The C-5 Doppler reliability varies with altitude, component installation and particular aircraft, but when operating properly, it provides extremely accurate information to our sophisticated computers.

The Loran-C system is somewhat different from what the older MAC navigators are used to. In the past, it was necessary to align pulses and evaluate an oscilloscope display before taking a reading and plotting out the respective LOPs. The C-5 Loran-C system is transistorized and provides signal information in digital readout form. It also displays malfunctions by multicolored warning lights and immediately tells the navigator when information is unusable or erroneous.

The multi-mode radar, operating in the X- and K- bands, has the capability of displaying ground returns on one scope and weather returns on another. The navigator, pilot and copilot each have scopes with simultaneous variable presentation capabilities. The X-band radar is used primarily as the weather avoidance radar and, in this respect, is an excellent piece of equipment. The K-band scope is used mainly for monitoring departures and approaches since it is primarily a low altitude, terrain avoidance radar system. During an approach, displays on the eight-inch navigator scope, using K-band radar, have all the fine detail of an X-ray or black-and-white photograph.

Obviously, one of the great potential dangers to the C-5 navigator is to become over reliant on the sophisticated computer systems and thereby lose individual proficiency in basic navigation techniques. When all systems malfunction, which will happen sooner or later, the C-5 navigator must be able to dig into his bag of tricks and pull out those cherished items called navigator judgment and basic DR proficiency. It is imperative that each navigator practice his basic navigation techniques, particularly celestial, in anticipation of that day when all of the black boxes simultaneously decide to go on vacation. Without continuous basic navigation practice, the "Computer-Nav" or "systems operator" could become a real liability in a system where precise navigation and close tolerances have become an absolute necessity.

I hope these few words on the C-5 and some of its systems will impress upon you the advances that have been made in navigation equipment on MAC aircraft. We've come a long way from the driftmeter, APN-9 Loran, astrocompass and hand-held sextant. And I'm sure that my transition from the T-29 at UNT directly to the C-5 is positive proof that mastering sophisticated navigation systems is within any navigator's capabilities. Navigating the C-5 for a little more than a year has been a highly rewarding experience for me, not only because of the aircraft, but also because the rest of the Galaxy team is comprised of true professionals who have made my initial operational assignment the finest that any new navigator (or old head for that matter), could possibly ask for.

Guest Cartoonist:

Major Stanley E. VAN HORN
Chief, Senior Staff Navigator Course
323d Flying Training Wing
Mather AFB, California

"They Call Me SAM"

Captain Ronald G. GUNDERMAN
98th Military Airlift Squadron
Andrews AFB, Washington DC

"I see an aircraft on final now. That's probably SAM. Maybe now we can get a crew bus and get to our bird."

"SAM must carry a pretty big stick to cause a ramp freeze and all this running and bustling."

"Yeah, that's quite a reception committee in front of Base Ops."

"We should have figured something was up when the Base Ops Officer wears a class A uniform on a 100 degree day."

Your crew continues the light patter while waiting for crew transportation to arrive. As a young crewmember just out of Navigator Training and recently qualified in your unit's aircraft, you are particularly interested in what's about to occur. This will be another interesting experience to add to the many that you have already gathered in your short career as an Air Force navigator.

If you haven't already guessed from your fellow crewmember's comments, SAM is not a person, but an acronym for Special Air Missions. That aircraft just landing out there belongs to the 89th Military Airlift Wing, Special Missions, Andrews AFB, Maryland. This Wing's mission is to provide worldwide airlift for the President, Vice President, Cabinet Members, and high ranking dignitaries of the United States government and other governments. All the formalities and reception activities you are witnessing are not for somone named Sam—they are for the VIPs (Very Important Persons) being transported aboard that aircraft.

As the big Boeing 707 taxies into view, you are immediately impressed with the elegance of the beautiful blue and white aircraft. The brightly polished stainless steel, light blue engine cowlings, the red, white, and blue American flag on the tail, and the expertly coordinated arrival all combine to lend an air of distinction and purpose to the operation. You also notice that it has "UNITED STATES OF AMERICA" painted on its side rather than the "US AIR FORCE" that is normally seen on Air Force aircraft. Even though the aircraft are flown and maintained by Air Force personnel, the unusual mission dictates that all the 89th birds are identified in this manner.

The instant the aircraft blocks, the doors open and the passenger steps are driven into place. Even before the engines whine down, Security Policemen hurry down the steps and take their positions around the aircraft. Your interest is now drawn to the group of distinguished looking men and women that appear at the open door and proceed down the steps to the reception line that has formed. Quickly following, in this series of obviously well-organized events, the dignitaries and members

of the reception committee enter impressive looking vehicles and are whisked away in convoy fashion.

As your attention reverts to the aircraft, you notice that the crew begins to disembark. The engineers immediately inspect the engine intakes, check tires and brakes and make preparations for refueling. The pilots and navigators deplane and head across the ramp to Base Operations. As they approach, your curiosity is aroused by the rather unique looking short-sleeved shirt your navigator counterpart is wearing. It is regulation blue but it has button-down pockets, rank insignia on the collar, and is worn with a tie and no blouse. He also wears a garrison cap rather than a flight cap like you've got wadded up in your pocket. You wonder how he manages to get away with wearing a uniform like that. But don't panic! It is a proper uniform authorized by the Vice Chief of Staff of the Air Force solely for use by the crewmembers of the 89 MAW. Just as the uniqueness of the mission requires special markings on the aircraft, it also requires special identification of the crewmembers. And this unique uniform, which you'll never find for sale in your clothing sales store or Base Exchange, serves that purpose very well.

As you watched this arrival, I'm sure many other questions came to your mind, just as a multitude of questions occurred to me as I witnessed my first SAC alert exercise. In the end, we can probably combine all these questions into one basic and simple question, "Just exactly how does the job of the SAM navigator differ from mine as an Air Force navigator? I know that he takes heading shots and celestial fixes, prepares flight plans and inflight AIREPS, maintains logs and charts, flies his share of grid, and shows for flights at every ungodly hour on the face of the clock, just like I do. But what does he do that I don't? Where does the difference come in?"

True, the duties of the Special Missions navigator definitely do differ from those of the majority of Air Force navigators, just as the individual duties of a navigator in one unit are different from those of nearly any other unit. But note that I am careful to say "differ from those of the majority." I certainly don't want anyone thinking that the SAM navigator believes he is the only navigator who has ever been to Peking, China, transported a DV, or parked in the number one spot in front of Base Operations. I know that this is not at all true. So let me just tell you what the 89 MAW is like and what the navigator does, and then you evaluate the differences yourself.

The 89th Military Airlift Wing is comprised of two flying squadrons, the 98th and 99th Military Airlift Squadrons. The 99th MAS, which picks up most of the short, state-side hauls, has no requirement for navigators. The 98th MAS, the unit that flies the long continental and intercontinental flights, has approximately 30 navigators assigned to it. All of the navigators in the 98th have previously been instructors or flight examiners and the average flying time is slightly over 7000 hours, ranging from a low of 3500 hours to a high of over 10,000 hours. Most of the navigators have some experience flying within the MAC system prior to their assignment to the 98th. Some, however, have recently completed tours in fighter aircraft or gunships and have been away from the transport operation for some time. These people face a major transition and must normally do a lot of extracurricular book work while concurrently becoming qualified in a new aircraft.

Initially, each new navigator is assigned to the Wing Navigation Briefing Section for approximately one week. During this period, he is given an introduction to current operating procedures, a review of new forms and documents, and an overall insight into the extensive responsibilities of his new area of management. He gets a lot of material in a short time, but he must master it since every part of this training will quickly become an important part of his standard operating procedures.

After completing an extensive ground and flying training program, initial qualification is completed in the VC-135B *Stratolifter*. Each new navigator can look forward to further qualification in the VC-118 or VC-137 as vacancies occur. The five VC-137s (Boeing 707s) are the only ones in the entire Air Force inventory and are equipped with dual Inertial Navigation systems. The pride of the Wing is "The Spirit of '76," a VC-137, aircraft number 27000. Using this specially designed Boeing 707, President Nixon was able to make his trips to Europe, the Middle East and the Soviet Union this past summer and still maintain instantaneous worldwide communications. This aircraft, or any other Air Force aircraft that carries the President, carries the call sign "Air Force One" when he is aboard. And even though the Presidential Pilots Office (PPO) is a separate unit within the 89th MAW, some navigators in the 98th MAS fly presidential support missions and also pull PPO alert.

Now let's take a close look at some of the preparation required for a Special Airlift Mission. There is really no such thing as a typical mission in the 98th MAS, so each mission, though similar in many respects, is different from any other one. Trips may vary in length from around 24 hours (augmented crew duty day is 27 hours) to over a month in rare cases. For example, you may recall that on May 31, 1974, Syria and Israel signed a cease-fire agreement. This occurred after a month of intensive negotiations conducted by Secretary of State Henry A. Kissinger, and required a marathon series of shuttles between Damascus and Tel Aviv. The entire trip consisted of 41 stops and, due to the nature of the mission and all the unknown quantitites involved, it was impossible to plan very far in advance. Nevertheless, in spite of the many long and difficult crew duty days, the trip was completed with the remarkable success that has become the trademark of Special Missions operations. When questioned about this trip, one of the crew navigators replied, "It was a very rewarding mission that gave us a deep sense of accomplishment."

The planning stage for such a trip to the Middle East, as is the case with most trips, begins shortly after mission notification from the office of the Vice Chief of Staff, USAF. The navigators selected for every flight must thoroughly review wind factor data and determine precise enroute leg times for the entire mission. This data will be used to establish a firm itinerary after the aircraft commander has coordinated the desired arrival and departure times with the Special Missions contact officer. The flight planning phase continues with extensive research into the Foreign Clearance Guide and its classified supplement when necessary. It's amazing how many countries have little idiosyncrasies that could produce great embarrassment if not detected in these publications. Many of the 98th's special missions also require overflight and/or landing clearances that must be requested well in advance of actual mission departure.

The next phase of predeparture planning involves checking the destination and alternate airfields in the Enroute Supplement to insure that they meet all requirements of the mission. You must evaluate support equipment, availability of servicing and maintenance, runway length and weight bearing capacity and a host of other pertinent requirements. Once this is completed, the navigator can now compute performance data to include maximum takeoff weights and planned fuel loads. Using the desired flight profile that will result in optimum fuel conservation, a required fuel onload can be determined for each enroute stop. Some of this information will be included in the initial message that is sent to the coordinating agencies at all enroute stops.

Much more data is collected through research of the Jeppesen Airway Manual, the civilian counterpart to the DOD publications. Many of our trips require planning into civilian airfields that are not depicted in our standard Air Force publications. For example, on a recent trip to Asia and the Middle East, a trip that lasted more than 30 days, 25 stops

were made and 21 of those were at civilian fields. One especially desirable feature of the Jeppesen manual is a large scale runway and taxiway diagram that can be very helpful when landing at an airfield for the first time. This excellent diagram can also be beneficial when it is necessary to coordinate block times down to the exact second.

Now that most of the research is complete, it's time to send out the message in order to comply with the specified lead times in the Foreign Clearance Guide. This message will identify the tail number and call sign of the aircraft that is scheduled for the mission. Additionally, all takeoff and landing times are forwarded along with servicing and fuel requirements, hotel reservations, desired transportation arrangements, and important information about the VIP and members of his party. One very significant part of each message is the correct addressee for each mission requirement. Can you imagine what would happen if Torrejon was to be one of the stops and they were never informed that you were coming?

After the message has been thoroughly scrutinized and sent, the navigator continues on with his predeparture duties. He prepares flight plans for the entire mission and drafts additional messages requesting computer flight plans from Global Weather Central at Offutt AFB and/or MAC Flight Planning at McGuire AFB. His predeparture work is just about finished when he packs his worldwide navigational kit. This kit contains sufficient charts to cover the entire route and any additional charts that might be required in the ever possible event of a route change.

As the scheduled departure time draws nearer, the numerous hours of predeparture planning finally draw to a close when the actual flight plan is filed. Aboard the aircraft, the navigator fills out a Passenger Information Card that will provide the distinguished passengers with information about the route of flight, enroute and destination weather, and other useful facts. In addition, the VIP will be furnished a National Geographic Chart that depicts the entire route of flight. Both of these tasks, in conjunction with the standard preflight duties, keep the navigator busy right up to engine start time.

The countdown to departure continues until the arrival of the VIP party and subsequent on-time takeoff. Once airborne, the job of a SAM navigator closely parallels that of the rest of his Air Force counterparts. He monitors the Standard Instrument Departure (SID) and advises the pilot as necessary to prevent deviations from the published procedures. Many of the SIDs flown by the pilots of the 89th MAW are extremely complex and executed at some of the busiest civilian airports in the world. This makes precise compliance with the published procedures absolutely necessary.

Enroute navigation in the VC-135 is accomplished with the use of Doppler, Loran, radar and celestial fixing aids—not really anything new to the typical many-motor navigator. And as mentioned previously, the five VC-137s are equipped with Litton Inertial Navigation Systems as well as the standard equipment. These aircraft also have elaborate communications systems that are frequently used to further coordinate enroute clearances and more closely plan arrival procedures and block times. Which brings us to one of the most important responsibilities of a SAM navigator, second only to navigation itself, coordination of block times. An early landing could lead to an embarrassing situation, particularly if all arrival preparations have not been completed. And, possibly worse, a late arrival may necessitate cancelling part of a busy VIP's schedule. For these reasons, the navigator must determine the landing runway as soon as possible and plan the entire enroute descent and taxi profile accordingly. The pilot is constantly advised of what speeds to fly and whatever maneuvering is necessary to arrive exactly on schedule. A SAM navigator's job is not perfectly accomplished until the aircraft blocks in at the very second advertised.

Shortly after arrival, the Wing Command Post at Andrews is notified of the exact block time and the next scheduled departure time. If the stop involves crew rest, they will also be informed as to where the crew will be staying. The Wing Command Post assumes command and control responsibility in addition to flight-following the aircraft until it arrives safely back at home base. Five navigators are permanently assigned to the Wing Command Post as Air Operations Officers and work around the clock to insure optimum support for all 89th missions. I could go on and on to describe the Command Post duties,but that's another story in itself and I'll save that until later.

Well, now, that simply and basically is the job of a typical SAM navigator. I'm certain that I've answered a lot of your questions about the SAM operation but I'm also sure that the answers generated a lot more questions. So the next time you encounter one of our SAM navigators, anywhere at all on this earth, just walk up, say "Hi SAM," and introduce yourself. I'm sure he'll be as interested in your job as you are in his and, if the situation permits, you'll probably end up swapping experiences over a tall, cool one.

Say, your crew bus is here now and the crew is waiting on you. Better grab your bags and get going so you can slip those surly bonds on time. See you around the system!

Target Timing Wind

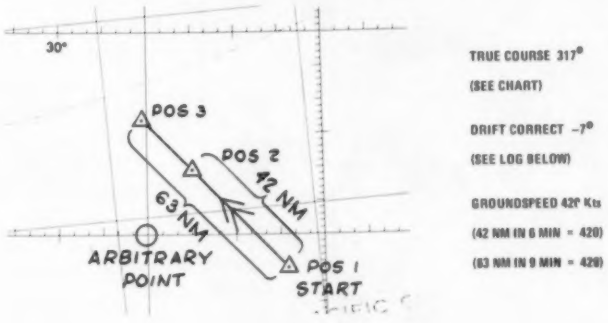
Major Glen L. SMITH
93rd Bomb Wing
Castle AFB, California

During normal operations in Doppler equipped aircraft, the navigator is provided with accurate groundspeed and drift. Doppler does, however, malfunction occasionally and it becomes necessary to obtain wind information from another source. The Target-Timing Wind (TTW) is an excellent source because any radar target can be used and does not even have to be identified on the chart.

The following method of obtaining a TTW is very simple and will provide an accurate groundspeed and drift. The key to getting accurate information is to select a target that can be tracked for a long distance on the scope—the farther the target is tracked, the greater the accuracy. For best results, select a small, well-defined return about 20nm either side of the heading marker. Soon after it appears on the edge of the scope, obtain a range and bearing from the target and simultaneously start a stop watch or note the exact time on a watch or clock. (See Example.) Plot position # 1 from an arbitrary point on the chart, using either true or grid north as appropriate. (This arbitrary point represents your radar target.) Track the target for exactly six minutes, take another range and bearing, and plot it from the same arbitrary point. When a six minute track is used, 10 times the distance from position # 1 to position # 2 equals the groundspeed. The direction between the two positions is the course and can be measured in either true or grid. If possible, obtain a third range and bearing before the target goes off the scope and again plot it from the same arbitrary point. In the case of a third reading, the computer may be needed to compute the groundspeed. In the example, the distance from position # 1 to position # 3 was 63nm in 9 minutes or a groundspeed of 420 knots.

Here are some tips to help insure maximum wind accuracy:

1. Insure that heading marker is striking on correct true or grid heading.
2. Select a small, well-defined return when possible. Land-water contrast is excellent, but avoid peaks and mountainous terrain.
3. When possible, select a target out in front of you and no more than 20nm on either side of the heading marker.
4. Using whole minutes of time will make it easier to compute the groundspeed.
5. Carefully compute slant range when distance from target is within critical range criteria.
6. Use the log to record data. Proper use of the log will eliminate some of the most frequently made errors.



TIME	FIX SYM.	PRESENT POSITION	T.C. OR G.C.	WIND	DC	T.H. OR G.H.	VAR OR ±PREC	M.H. OR AGH	TAS	AIR DIST	DIST / TIME	GS
TTW			317	245 / 57	−7	310	−17	293	440		42/63 / 06/09	420

Cockpit Quips

Here are the actual regulations concerning operation of aircraft as set forth by the United States Air Service in 1920:

1. Don't take the machine into the air unless you are satisfied it will fly.
2. Never leave the ground with the motor leaking.
3. Don't turn sharply when taxiing. Instead of turning short, have someone lift the tail around.
4. Never get out of a machine with the motor running until the pilot relieving you can reach the engine controls.
5. Pilots should carry hankies in a handy position to wipe off goggles.
6. Riding on the steps, wings or tail of a machine is prohibited.
7. In case the engine fails on takeoff, land straight ahead regardless of obstacles.
8. No machine must taxi faster than a man can walk.
9. Do not trust altitude instruments.
10. If you see another machine near you, get out of its way.
11. Before you begin a landing glide, see that no machines are under you.
12. Hedge- hopping will not be tolerated.
13. No spins on back or tail slides will be indulged in as they unnecessarily strain the machine.
14. Pilots will not wear spurs while flying.
15. If an emergency occurs while flying, land as soon as you can.

Answers to NAVWORDS puzzle from page 15.

1 C	2 A	3 G	E	■	4 I	5 N	6 F	7 R	A	8 R	E	9 D	10	
11 O	R	I	■	12 G	N	O	M	E	■	13 A	V	E		
14 M	I	M	15 E	■	■	■	■	16 N	17 A	D	I	R		
18 P	E	B	B	19 L	20 E	21 S	■	22 E	X	I	L	E		
23 A	S	A	■	24 O	T	A	L	G	I	A	■	L		
S	■	25 L	U	N	A	R	■	26 E	O	T	■	I		
27 S	28 O	S	■	G	■	■	29 S	■	30 M	E	■	C		
■	M	■	31 N	I	32 M	33 B	U	34 S	■	35 S	36 A	T		
37 L	E	38 O	■	39 T	I	A	R	A	■	■	40 S	S		
■	41 G	R	O	U	N	D	■	42 M	43 E	44 A	■	■		
45 P	A	D	■	46 D	O	■	47 H	■	48 C	R	49 U	50 X		
U	■	51 I	52 N	E	R	53 T	I	54 A	L	■	55 R	B		
56 L	57 A	N	E	■	■	58 O	M	N	I	■	59 S	A		
60 S	T	A	T	61 I	62 C	■	■	■	63 P	64 L	A	N		
65 E	A	T	■	66 D	I	67 V	E	68 R	S	E	■	D		
S	■	E	■	69 L	A	N	D	■	70 E	T	A	S		

POW Anecdote

Major Edward HUBBARD
58th Tactical Fighter Training Wing
Luke AFB, Arizona

Editor's Note: Major Ed Hubbard was shot down over North Vietnam on 20 July 1966 and was released on 4 March 1973. As evidenced by the true anecdote he related to me in mid-July of this year, he has obviously maintained his sense of humor throughout.

When we were shot down and captured by the North Vietnamese, it happened at a time when I was the first AF navigator they had ever seen. When I was confronted by my interrogator, the following dialogue took place:

Him: Ahhh, another pilot, yes?

Me: No, I'm a navigator.

Him: Navigator? I do not understand. You come down from sky in parachute, yes? You must be pilot.

Me: No, I'm the guy on the airplane who knows where we are.

Him: You no fly airplane? Where you sit?

Me: No, I don't fly. The pilot sits in front and I sit in back.

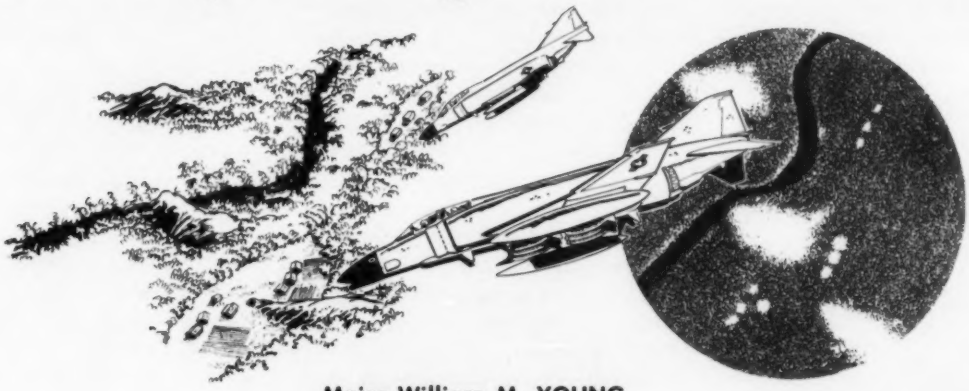
Him: But what work you do on airplane?

Me: I tell the pilot where to go. I tap his left shoulder to go left and his right shoulder to go right. I'm the guy who makes all the decisions as to what we do and where we go.

Him: Ahh, now I see. You what they call aircraft commander, yes?

Me: Now you got it, pal!

Radar Bombing - art or science?



Major William M. YOUNG
323 Tactical Fighter Wing
APO San Francisco

What is an art, and what is a science? Webster defines an art as "skill acquired by experience, study, or observation.... a branch of learning.... an occupation requiring knowledge or skill.... the conscious use of skill and imagination.... " There are many other specific definitions, but I think we can paraphrase them all into one sentence. An art is the ability or skill to take continually changing variables, assemble them in an orderly fashion, evaluate them on a timely basis, and react in such a way as to produce desired results. A science is defined by Mr. Webster as "possession of knowledge as distinguished from ignorance or misunderstanding.... knowledge covering general truths or the operation of general laws.... " Once again, I think we can paraphrase these definitions into one by saying: A science is any natural law that is predictable and can be relied upon to remain constant.

When a study of the arts and sciences and their application to our daily lives is undertaken, it is discovered that most times it is difficult to separate them.

Take for example mathematics, which is probably the purest form of science. While two plus two is always equal to four, we find that in the practical application of math, there are usually several ways of arriving at the same correct answer. For instance, consider the solution of the true airspeed problem while airborne. Given all the variables of indicated airspeed, Mach number, altitude, outside air temperature, heading, wind, and groundspeed, there are at least three different methods of arriving at the desired solution. Which method is used depends upon individual judgement of instrument accuracies, type aircraft being flown, ease of computation, accuracy requirements, and personal preference. In short, the selection of the method used becomes somewhat of an art.

On the other hand, let us look at the game of chess, which would be considered one of the purer forms of art. There are certain rules by which the game is governed and to which all players must conform. These rules, which can be taught in a relatively short period of time, could be considered the scientific aspect of the game. While certain portions of the art of playing chess can also be taught, i.e., standard opening moves, fools mate, etc., the degree of proficiency of the chess player is usually proportional to the time he has spent playing the game.

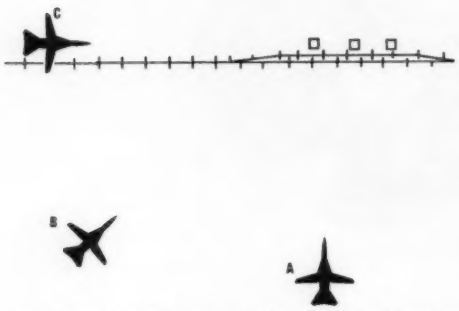
In short, we conclude that most tasks that we perform on a daily basis utilize both the arts and sciences. The sciences are relatively stable and unchanging, and are readily taught in the academic classroom. The arts, while certain portions can be taught in the classroom, are mainly taught through the experiences of everyday life.

Radar bombing is no exception to this. There are very definite scientific principles involved that make radar predictable. There is also a very definite art to placing a bomb on target, in the black of night, in an alien environment such as North Vietnam.

RADAR BOMBING—THE SCIENCE

Let us look first at the scientific aspect of radar. A complete, thorough, exhaustive analysis of all the scientific principles would take volumes and, indeed, volumes have been written. For our purpose of analyzing the scientific aspect, I would like to limit the scope of it to axis of attack or radar look angle only. We'll take a look at both cultural and terrain features and

see how changing the axis of attack changes the radar presentation and oftentimes makes a specific return nondefinable or unacceptably large.



All radar scope depictions are line of sight (i.e., the top of the radar display always equates to the nose of the aircraft). All radar predictions illustrating this article were created by Sergeant David N. Samples of the 347th Tactical Fighter Wing.

Figure 1

Consider the culturally radar significant area that is depicted in Figure 1. This diagram is indicative of the grain elevators that are quite common along rail networks in the USA's Midwest. We'll assume that each of these buildings is 200 feet square and separated by 400 feet. An aircraft approaching this complex from position A would paint a radar picture similar to that depicted in Figure 1a. In this presentation, we would have all three structures blended together into one huge return. The actual size of this return would be a function of the width of the radar beam, the aircraft range from the complex, and the radar gain setting. When the aircraft range is ten miles from the complex, this return on the radarscope would be 2200 to 2600 feet in azimuth. The F-111A/E has a seven-inch radarscope with the largest magnification being five miles. This means, that on the scope, one inch is equal to approximately 4300 feet. So we can see that under the most optimum conditions of the finest tuned radar, we're talking about a radar return that is about one-half inch long. Selecting one of these buildings as an aimpoint and attempting to place radar cursors on it with any degree of accuracy would be extremely difficult, if not impossible. Add to this the possibility of railroad cars on the siding, and you have significantly increased the size of the return in range and, possibly, in azimuth if there were a great number of cars. The embankment on which the rail line is built may or may not show, depending on aircraft altitude. If it does show, it would be a definite aid in helping to identify the elevator complex.

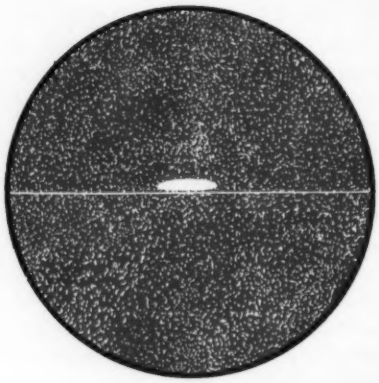


Figure 1a

Figure 1b

Let us move the aircraft to position B in Figure 1, where the aircraft is now approaching the complex at a forty-five degree angle. Once again, when the aircraft is ten miles from the complex, we would find a radar presentation similar to that shown in Figure 1b. Instead of having all three buildings blend together into one return as in Figure 1a, we can now detect a range separation. All three buildings will paint as separate returns, each return being between 1000 to 1400 feet in azimuth. However, the inherent radar errors will cause the returns to blend together, and separating the center of any one building would be extremely diffucult. Any railroad cars that might be present on the siding would not show nearly as strongly as they would from position A, since they are no longer perpendicular to the radar beam. For the same reason, the railroad embankment would not show nearly as strongly. Most probably, it would not show at all until the aircraft was much closer than ten miles.

Figure 1c

Finally, let us consider the presentation for an aircraft approaching the complex from position C. Figure 1c shows all three buildings completely separated on the radar. Each of the three returns would once again be 1000 to 1400 feet in azimuth. Since the approach

is now parallel to the railroad, neither the tracks themselves nor any cars present on the siding would present a radar cross section significant enough to show on radar.

It can readily be seen that, even in this relatively simple cultural complex, the angle from which it is observed makes a significant difference in the radar presentation. Place this complex in a highly urbanized area where there are schools, houses, warehouses, and office buildings, and take into account the other radar variables such as building size, shape, construction materials, relative position of the buildings, and aircraft altitude, and the axis of attack or radar look angle takes on even greater significance.

Let us now turn our attention to terrain features and see what effect our axis of attack has upon these presentations.

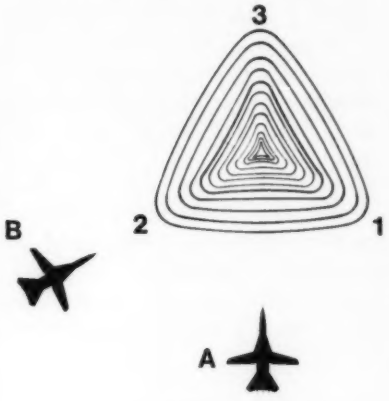


Figure 2

The ideal or theoretical hill is depicted in Figure 2. This hill, under the most ideal conditions, would be sitting by itself with flat terrain surrounding the base of it. It would have three ridges running from the base to the peak with each ridge equally spaced by 120 degrees of arc. As the peak is approached, the contour gradient becomes tighter to such an extent that at the peak we have nearly zero dimensions and sheer cliffs.

Figure 2a

We have depicted in Figure 2a the radar presentation for an aircraft that is approaching this hill from position A in Figure 2. In this case, ridge lines 1 and 2 completely shadow the rest of the hill, and what we have for a return is the face of the hill that is perpendicular to the nose of the aircraft. The peak would be the point that is the greatest range from the aircraft, or the apex of the 120 degree cone.

Figure 2b

Moving the aircraft to position B will give a presentation as depicted in Figure 2b. In this case, all three ridge lines are displayed on the scope. Ridge line 2 is right on the nose and cannot be easily distinguished since the entire hill from ridge line 1 to 2 to 3 is being painted on the scope. In this case, the face of the hill between ridge lines 3 and 1 is shadowed and will not show on the radar. The top of the hill is, once again, easily definable in the crotch of the 120 degree shadow.

It can be seen that this hill is truly omnidirectional, in that the peak is very well defined regardless of the axis of attack.

Figure 3

However, since the ideal or theoretical hill rarely, if ever, exists, let's take a look at the more practical aspects of terrain feature aimpoints. Figure 3 is a portion of a 1:500,000 scale Army Map Service chart that covers a portion of North Vietnam. The contours and spot elevations expressed on this chart are in meters with a contour interval of twenty meters. For our purpose, let us consider the peak in line with the nose of aircraft A in Figure 3 that is surrounded by the 1080 meter contour and is the high point along the ridge that runs from 1 to 2 (as illustrated in Figures 3a through 3d). This peak, while not the highest in the area, does possess many of the qualities of the

ideal or theoretical hill depicted in Figure 2, i.e., it has a fairly tight contour gradient at the peak, and the ridge line running from the 1306 meter peak to the 1080 meter peak intersects the ridge line running from 1 to 2 at approximately a ninety-degree angle.

So, let us consider this peak from four different vantage points. Aircraft altitude is also a very important variable in radar presentations. This is especially true when dealing with terrain features and their resultant shadows. For our purpose, we will consider the radar presentations from the F-111 TFR environment. We'll assume the surrounding terrain to be flat and the aircraft to be approaching at an altitude of 1000 meters MSL.

An aircraft approaching from position A will have a radar presentation as depicted in Figure 3a. For ease of correlating the presentation to the chart, the ridge lines numbered 1 and 2 and the 1306 meter peak are annotated on the radar displays, and the aimpoint is centered in a circle. It can be seen in this presentation that the point is very well defined.

Figure 3a

Figure 3b gives a radar presentation for an aircraft approaching from position B. The entire face of the hill from 1 to 2 will be painted with the 1080 meter peak about halfway across the return. The length of this return is about 4500 feet. Center aiming a return this large with any degree of accuracy is an impossible task. The higher rising terrain behind the aimpoint would be displayed as completely separate returns on this axis.

Figure 3b

Moving around to position C, we find the presentation depicted in Figure 3c. It is very similar to that which was depicted in Figure 3a. Once again, we find the peak is very well defined and, certainly, very usable as an aimpoint.

Figure 3c

When we move to position D, we find that our aimpoint is completely obliterated by shadow from the higher ridges coming off the 1306 meter peak as depicted in Figure 3d. We find the aimpoint from this axis to be completely useless.

Figure 3d

In summary, we have seen how changing the axis of attack or radar look angle will completely change the radar presentation. This would lead us to the undeniable conclusion that the aimpoint selected for bombing must be tailored to the axis of attack. This further points out a limitation of radar. If the aimpoint and axis of attack are tied together, then the target must, of necessity, be preplanned. We cannot alter the scientific fact that radar bombing has certain limitations. Failure to recognize these limitations and to operate within them will produce less than optimum results.

RADAR BOMBING—THE ART

As we noticed in our earlier definitions of an art, such words as skill, knowledge, creative imagination, and changing variables seemed to stand out. To try to discuss such fluid words as they pertain to radar bombing is an impossible task. Each and every set of circumstances is different, and they must be treated differently in light of the various

situations in which they exist. So, instead of looking at the specifics which, by the very nature of an art, change so drastically, we'll take a look at the more general aspects of what goes into making an artist.

The first requirement for any successful radar bomb aimer is that he master the scientific aspects of radar. These are the concrete ground rules that will never change. It is upon this wealth of knowledge that he can draw when the computer says thirty seconds to go to bomb release, and the aimpoint is nowhere in sight. If you're going to play a ball game, you've got to know the rules, or you'll be a last place finisher every time.

The second requirement is very much like the first. You've got to know your equipment. Every aircraft and every radar is different, and each has its own idiosyncrasies and limitations. I can't recall the number of times I've sat in a classroom studying the systems of a new aircraft, and someone has raised his hand and said, "Don't give me all that baloney about what does what when... just tell me what the switch does, it either works or it doesn't, and if it doesn't work, I can't do anything about it anyway." This attitude, of course, limits the individual's scope and understanding of the equipment with which he is working, and in my judgement, Peter's Principle already applies to him. I've never read an accident or incident report where the individuals involved knew too much about their equipment.

The third requirement is that target study and radar film critiques become a way of life with him. The importance of this cannot be over-emphasized. When I refer to target study, I'm not talking about the kind of target study an individual gets just ten minutes prior to going out to the aircraft, when he comes running into Radar Strike, grabs a roll of radar film and says, "Hey, boss, show me where to put the crosshairs, and I'll lay 'em in there fer ya!" The target study that I'm referring to is where an individual comes in four or five hours prior to flight, sits down with a Radar Strike Officer, and without the aid of radar film they select an aimpoint and axis of attack. He sketches himself some predictions, and then he goes out to the aircraft to go bomb. When he returns, he sits down at a Recordak with his film and predictions, and he spends a couple more hours analyzing his results. What caused a particular shadow to appear on his film that he hadn't predicted? Why didn't the river show like he thought it would? These questions can be answered in a thorough post-flight critique. The effort and energy expended here will be well rewarded. You'll learn far more about the art of radar bombing here than airborne between the IP and target.

The fourth requirement is experience, and it goes hand in hand with the third. The average line jock has very little control over this; however, he can make the most out of every flight that he gets. A review of the flying time of one of our tactical F-111 squadrons shortly after the Linebacker II operations over North Vietnam revealed an average left seat time of 3040 hours while the average right seat time was 1080 hours. Only as we build the experience level of our right seat force can we expect to fully exploit the full potential of the F-111 weapon system. An artist has to ply his trade if he is ever going to be a master of his art.

The fifth requirement I would call motivation or desire, and in reality, it is nothing more than a compilation of the first four. It is that inner drive, the desire to excel that makes the artist a master of his trade. It is the professional surgeon laboring over a patient for hours on end, totally dedicated to his calling in life, and, when complications or unforeseen problems arise, the improvision of ways to cope with them. It is that total dedication of the radar bombardier that will put the bombs on target in spite of poor predictions and malfunctioning equipment. An individual who has set for himself the goal of mastering his art has to work and work and work some more; and when he thinks he has achieved his goal and sits back to evaluate all that he has done, he only has to look to the horizons beyond to realize how little he has really accomplished in mastering his art. Motivation, dedication, professionalism, desire, personal drive—you can call it whatever you like, but an individual who hasn't got it isn't an artist.

CONCLUSION

I think we can agree that radar bombing utilizes both the arts and the sciences. Is it more art than science or more science than art? I'll not argue that point either way. What is imperative is that we recognize the importance of both. We must insure that we have a well-balanced training program that will meet the requirements of both. Each and every aircrew member must insure that he has done everything within his power to master both the art and the science of his profession. It is only in this way that we can be assured of exploiting our weapon systems to their maximum potential.

Editor's Note: This article is a reprint from the Spring 1974 issue of USAF Fighter Weapons Review.

Test Navigator/Flight Test Engineer Career?

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6512 Test Squadron
Edwards AFB, California

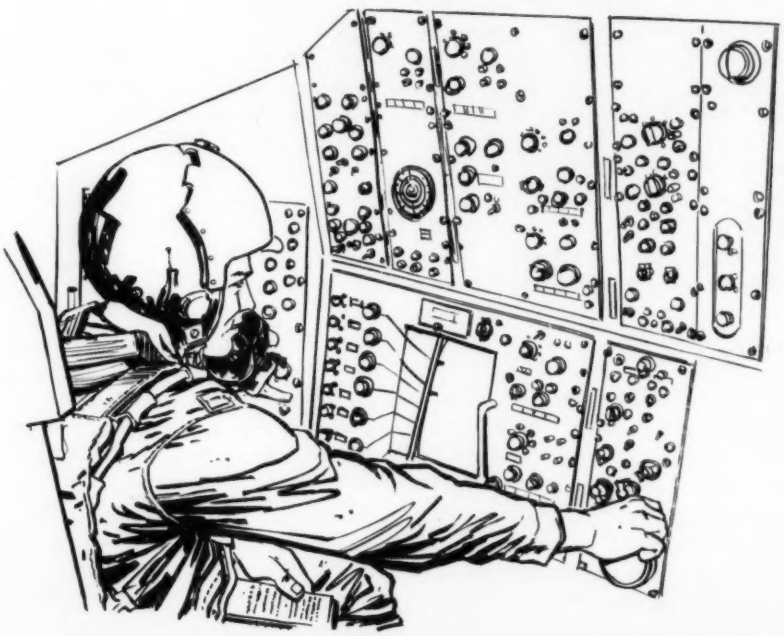
From my position as a navigator assigned to the 6512th Flight Test Squadron at Edwards AFB, I look with envy at the opportunities young navigators have today to succeed in the flight test business. The horizons have broadened and jobs that navigators never would have been considered for previously are now wide open to them.

In years past, navigators were assigned to the various flight test bases in Systems Command purely as chance would have it; the old, "pay your money, take your chances" approach that we all detest so much. But because of change made necessary by the high educational, interest, and achievement levels held by so many young navigators, the flight test business on a planned rather than random assignment basis has become a reality. In August of this year, the first of a new breed attended the Test Pilot School/ Flight Test Engineer Course at Edwards AFB. The first navigator with the flight test navigator option began training. It was indeed a landmark in the navigator career field.

This article is an obligation on my part to generate interest among navigators and encourage them to apply for entry into the Flight Test Engineer's Course—Nav Option. I have been in the flight test business since 1953 and it has been my great fortune to have worked on flight test systems evaluation programs on three separate tours. The first tour dealt with projects on the H-21, B-52, B-66, and F-101A. The middle tour encompassed the F-4C, RF-4C, CH-3C and the ARIA-EC-135. And, in the present tour, I have worked with the F-111 E, D and F, the C-5A, and as test director for the T-43A navigation trainer. The exposure has been unlimited, the work rewarding beyond description, and the association with fellow workers unparalleled.

Work in flight test is exactly that—hard work and lots of it. The exotic is not the normal state of affairs as one might believe. Planned routines are established for testing and are followed meticulously. Your job will require patience and a ratio of planning/ writing hours to flying hours that you have probably never encountered before. But all the years of meticulous, systematic diligence have been well worth it to me and have culminated in my working on systems evaluation of the Navy F-14A for the Air Force. This effort alone has made it all worth it.

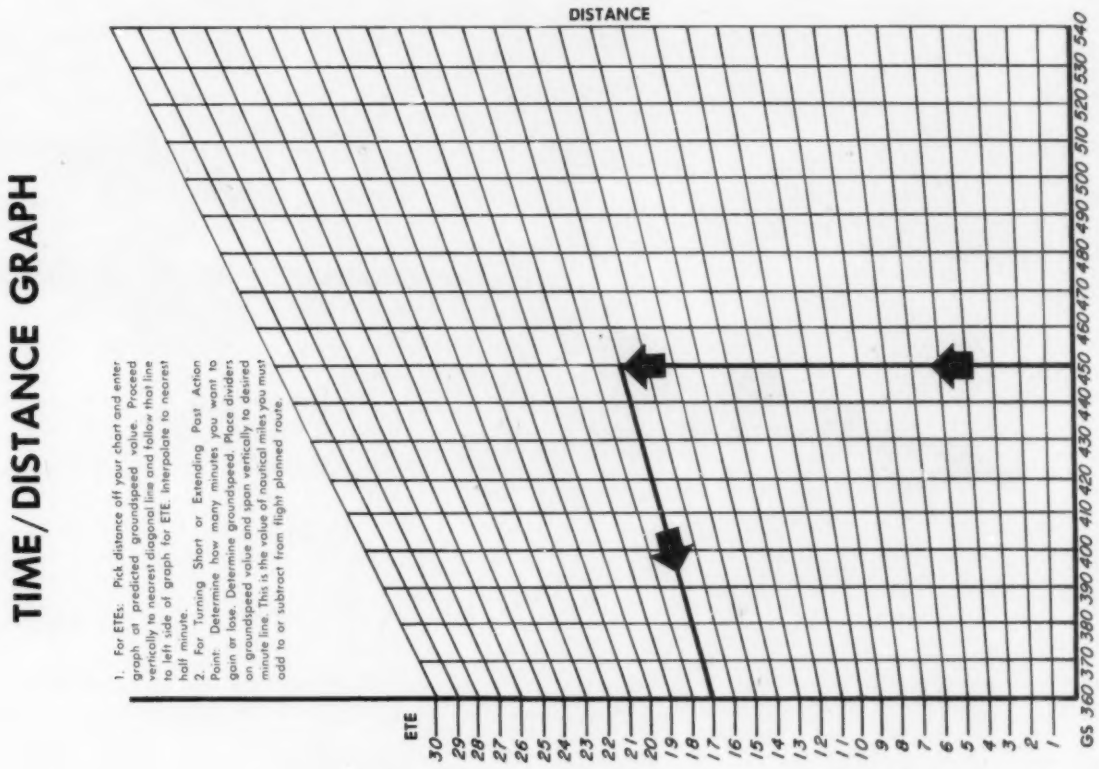
So if you have a physical science degree, an inquisitive nature, and a yearning to associate with new products, get your hands on a copy of AFR 53-19 and submit your paperwork. I promise you the rewards will be greater than you could ever imagine.



TIME/DISTANCE GRAPH

2nd Lt Douglas H. BEABOUT
97th Bomb Wing
Blytheville AFB, Arkansas

For you chart buffs who like handy little gadgets, you might find this one interesting. Be advised that it is accurate to a half minute but only between latitudes 30 to 50 N or S, and on the JN series charts.


TIME/DISTANCE GRAPH
DISTANCE
ETE
30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
GS 360 370 380 390 400 410 420 430 440 450 460 470 480 490 500 510 520 530 540
1. For ETEs: Pick distance off your chart and enter graph at predicted groundspeed value. Proceed vertically to nearest diagonal line and follow that line to left side of graph for ETE. Interpolate to nearest half minute.
2. For Turning Short or Extending Post Action Point: Determine how many minutes you want to gain or lose. Determine groundspeed. Place dividers on groundspeed value and span vertically to desired minute line. This is the value of nautical miles you must add to or subtract from flight planned route.

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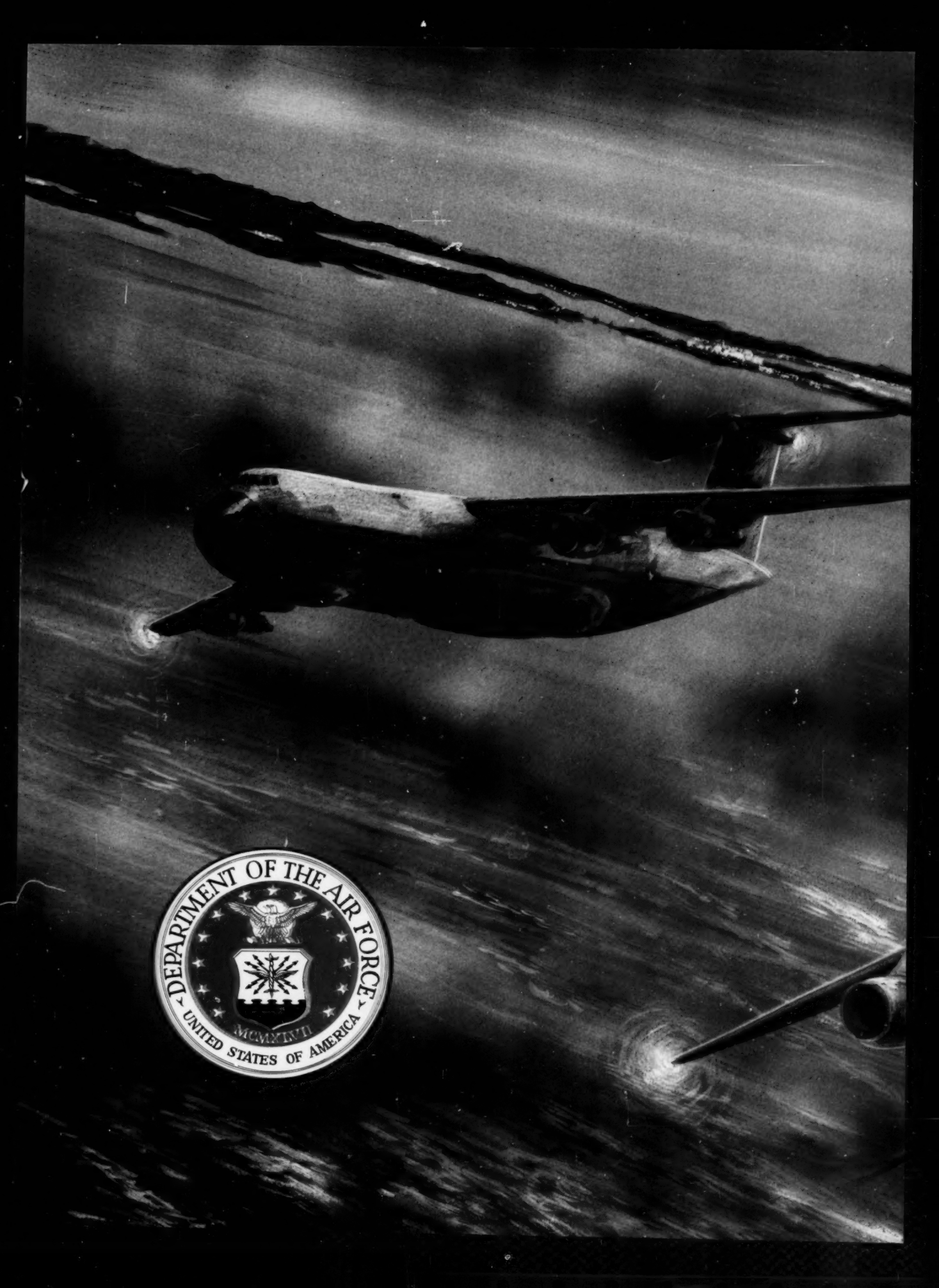
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